

IN THE CLAIMS

1. (previously presented) A method of sealing a vacuum membrane to a surface, comprising the steps of:

defining a vacuum zone on the surface including placing a double-stick tape on the surface at a boundary of said vacuum zone;

placing a breather over the surface within said vacuum zone;

placing a membrane over said breather, said membrane covering said vacuum zone;

forming a vacuum seal between said membrane and the surface; and

covering said vacuum seal with a laminate release surface.

2. (canceled)

3. (original) The method of claim 1, wherein said step of placing said breather comprises adhering said breather to the surface inside said vacuum zone.

4. (original) The method of claim 1, wherein said step of forming said vacuum seal comprises sticking said membrane to an exposed side of a double stick tape adhered to the surface at a boundary of said vacuum zone.

5. (original) The method of claim 1, wherein said step of forming said vacuum seal comprises covering an edge of said membrane with a seal tape, said seal tape adhering to said membrane and to the surface.

6. (original) The method of claim 1, wherein said step of covering said vacuum seal comprises covering said vacuum seal with a teflon tape.

7. (original) The method of claim 1, further comprising a step of:
applying a vacuum to an interior space between the surface and said membrane.

8. (original) The method of claim 1, further comprising a step of:
holding said membrane on the surface over said vacuum zone by applying a vacuum underneath said membrane and over said surface.

9. (original) The method of claim 8, wherein said holding step includes applying said vacuum through a vacuum port in said mandrel tool.

10. (original) A method of forming individual vacuum zones on a lay-up surface of a mandrel tool, comprising the steps of:

defining a first vacuum zone on the lay-up surface;

defining a second vacuum zone on the lay-up surface;

placing a first breather over the lay-up surface within said first vacuum zone;

placing a second breather over the lay-up surface within said second vacuum zone;

placing a first membrane over said first breather, said first membrane covering said first vacuum zone;

placing a second membrane over said second breather, said second membrane covering said second vacuum zone;

forming a first vacuum seal between said first membrane and the lay-up surface;

forming a second vacuum seal between said second membrane and the lay-up surface;

covering said first vacuum seal with a first laminate release surface; and

covering said second vacuum seal with a second laminate release surface.

11. (original) The method of claim 10, further comprising a step of:
holding said first membrane to the lay-up surface at said first vacuum zone by applying a first vacuum to a first interior space between the lay-up surface and said first membrane, said first breather being within said first interior space.

12. (original) The method of claim 10, further comprising a step of:
holding said second membrane to the lay-up surface at said second vacuum zone by applying a second vacuum to a second interior space between the lay-up surface and said second membrane, said second breather being within said second interior space.

13. (original) The method of claim 10, further comprising a step of:
providing a rebate in the lay-up surface between said first vacuum seal and said second vacuum seal.

14. (original) The method of claim 10, further comprising steps of:
laying up a composite laminate skin on said lay-up surface over said first membrane, said first laminate release surface, said second membrane, and said second laminate release surface; and
cutting said composite laminate skin between said first vacuum seal and said second vacuum seal.

15. (original) The method of claim 10, wherein said step of defining said first vacuum zone comprises:
placing a double-stick tape on the lay-up surface at a first boundary of said first vacuum zone to be smoothly covered by a composite laminate skin; and
forming a conventional vacuum seal at a second boundary of said first vacuum zone not to be covered by said composite laminate skin.

16. (original) A method of transferring an uncured composite laminate skin from a lay-up surface of a male mandrel tool to a female cure tool, comprising the steps of:
defining a first vacuum zone on the lay-up surface by applying a first double-stick tape to the lay-up surface;
defining a second vacuum zone on the lay-up surface by applying a second double-stick tape to the lay-up surface, wherein said first vacuum zone and said second vacuum zone are adjacent;
placing a first breather over the lay-up surface within said first vacuum zone;

placing a second breather over the lay-up surface within said second vacuum zone;

placing a first membrane over said first breather, said first membrane covering said first vacuum zone, and adhering said first membrane to said first double-stick tape;

placing a second membrane over said second breather, said second membrane covering said second vacuum zone, and adhering said second membrane to said second double-stick tape;

forming a first redundant vacuum seal between said first membrane and the lay-up surface by covering a first edge of said first membrane with a first seal tape, said first seal tape adhering to said first membrane and to the lay-up surface;

forming a second redundant vacuum seal between said second membrane and the lay-up surface by covering a second edge of said second membrane with a second seal tape, said second seal tape adhering to said second membrane and to the lay-up surface, wherein said second redundant vacuum seal is adjacent to said first redundant vacuum seal;

covering said first redundant vacuum seal with a first laminate release surface;

covering said second redundant vacuum seal with a second laminate release surface;

laying up a composite laminate skin on said lay-up surface over said first vacuum zone and over said second vacuum zone, wherein:

said composite laminate skin smoothly covers said first redundant vacuum seal and said second redundant vacuum seal adjacent to said first redundant vacuum seal; and

said composite laminate skin smoothly covers said first membrane and said first laminate release surface, said second membrane and said second laminate release surface.

17. (original) The method of claim 16, further comprising steps of:

applying a first vacuum to said first vacuum zone, wherein said first vacuum is applied to a first interior space between the lay-up surface and said first membrane, said first breather being within said first interior space;

applying a second vacuum to said second vacuum zone, wherein said second vacuum is applied to a second interior space between the lay-up surface and said second membrane, said second breather being within said second interior space;

cutting said composite laminate skin between said first vacuum zone and said second vacuum zone, wherein said cutting step produces a first portion of said composite laminate skin over said first vacuum zone and a second portion of said composite laminate skin over said second vacuum zone;

holding said first membrane and said first portion to the lay-up surface at said first vacuum zone using said first vacuum; and

holding said second membrane and said second portion to the lay-up surface at said second vacuum zone using said second vacuum.

18. (original) The method of claim 16, further comprising steps of:
providing a rebate in the lay-up surface between said first vacuum seal and said second vacuum seal; and
cutting said composite laminate skin over said rebate.

19. (original) The method of claim 16, further comprising steps of:
cutting said composite laminate skin between said first vacuum zone and said second vacuum zone;
releasing said first vacuum; and
allowing a first portion of said composite laminate skin to drop into a cure tool.

20. (original) The method of claim 16, further comprising steps of:
cutting said composite laminate skin between said first vacuum zone and said second vacuum zone, wherein said cutting step produces a first portion of said composite laminate skin over said first vacuum zone and a second portion of said composite laminate skin over said second vacuum zone;
orienting said mandrel tool so that said second vacuum zone and said second portion are disposed above a cure tool;
releasing said second vacuum; and
allowing said second portion of said composite laminate skin to drop into said cure tool.

21 -25. (canceled)

26. (original) A method of transferring an uncured composite laminate skin from a lay-up surface of a mandrel tool to a cure tool, comprising:

a step for forming a first low profile seal of a first membrane to a surface of a mandrel tool at a first vacuum zone;

a step for forming a second low profile seal of a second membrane to a surface of a mandrel tool at a second vacuum zone;

a step for smoothly laying up a composite laminate skin over said first vacuum zone and said second vacuum zone;

a step for separating said composite laminate skin into a first portion over said first vacuum zone and a second portion over said second vacuum zone; and

a step for releasing said first portion individually of said second portion into a first cure tool.

27. (original) The method of claim 26, wherein said step for forming a first low profile seal includes a step for adhering said first membrane to said surface.

28. (original) The method of claim 26, wherein said step for forming a first low profile seal includes a step for providing a laminate release surface over said low profile seal.

29. (original) The method of claim 26, wherein said step for releasing includes a step for orienting said mandrel tool to dispose said second portion above a second cure tool and releasing said second portion into said second cure tool.

30. (previously amended) A tool for manufacturing large aircraft parts, comprising:
a male mandrel tool having a lay-up surface;
at least one vacuum zone defined on said lay-up surface by a low profile vacuum seal at a boundary of said vacuum zone;

a double stick tape included in said low profile vacuum seal at said boundary of said at least one vacuum zone;

a membrane covering said at least one vacuum zone wherein said low profile vacuum seal forms a vacuum seal between said membrane and said lay-up, surface; and
a laminate release surface covering said low profile vacuum seal.

31. (canceled)

32. (previously presented) The tool of claim 30 further comprising:
an automated tape laying machine, wherein said automated tape laying machine places a composite laminate material smoothly over said low profile vacuum seal.

33. (previously presented) A system for manufacturing large aircraft parts, comprising:

a multiple head automated tape laying machine;

a male mandrel lay-up tool having a lay-up surface with a plurality of vacuum zones defined on said lay-up surface including:

a first vacuum zone of said plurality of vacuum zones, said first vacuum zone having a first low profile vacuum seal at a first boundary of said first vacuum zone;

a second vacuum zone of said plurality of vacuum zones; said second vacuum zone having a second low profile vacuum seal at a second boundary of said second vacuum zone; and

a rebate that separates said first vacuum zone from said second vacuum zone; and

a plurality of female cure tools.

34. (canceled)

35. (original) The system of claim 33 further comprising:
a first vacuum zone of said plurality of vacuum zones, said first vacuum zone having a first low profile vacuum seal at a first boundary of said first vacuum zone;

a first membrane covering said first vacuum zone wherein said first low profile vacuum seal forms a first vacuum seal between said first membrane and said lay-up surface;

a second vacuum zone of said plurality of vacuum zones; said second vacuum zone having a second low profile vacuum seal at a second boundary of said second vacuum zone;

a second membrane covering second vacuum zone wherein said second low profile vacuum seal forms a second vacuum seal between said second membrane and said lay-up surface; and

a rebate that lies between said first low profile vacuum seal and said second low profile vacuum seal, wherein said multiple head automated tape laying machine places a composite laminate material smoothly over said first low profile vacuum seal, said rebate, and said second low profile vacuum seal without bridging.

36-55. (canceled)